# CONSERVATION ASSESSMENT FOR THE

# COMMON BLACK-HAWK (*BUTEOGALLUS ANTHRACINUS*)

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Final Report
USDA Forest Service
Tonto National Forest
P.O. No. 43-8180-5-0271

14 April, 1996

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The common black-hawk (*Buteogallus anthracinus*) is a neotropical raptor. It is a permanent resident in the tropics from southern Mexico to northern South America. A migratory population breeds as far north as southern Utah, Arizona, southwest New Mexico, and western Texas in the U.S., and Sonora and Chihuahua in Mexico. The breeding population in the U.S. in the mid 1970's was about 220-250 pairs; most (80-90%) of the pairs nested in Arizona (Schnell et al. 1988). The common black-hawk in the southwestern U.S. is dependent upon riparian communities for nest trees and prey. The trophic position of the common black-hawk and its habitat affiliation within riparian communities suggest it may serve as an indicator of healthy mature riparian systems.

## Assessment Goal

The goal of this conservation assessment is to evaluate what is known about *Buteogallus anthracinus*, and to develop a course of action that will contribute to the conservation and management of the species in the southwestern U.S. In particular, our objectives are to evaluate the current status of the common black-hawk in the U.S., prioritize research needs for the species, and develop recommendations for proactive management.

## Assessment Development

This assessment is based on the best available information. The common black-hawk is a poorly studied species and the available information is limited, especially in the southern

extents of its range. Furthermore, much of what is available is anecdotal rather than quantitative. We compiled the information from peer reviewed journals, symposium proceedings, unpublished governmental and non-governmental reports, and state heritage data bases. We conversed and corresponded with many foreign and domestic researchers (Appendix 5) that have either worked with the species or have access to the best local data. Finally, we reviewed nesting/distribution reports made available by various researchers. The most extensive investigation of the life history of common black-hawks has been conducted by Dr. Jay Schnell at Aravaipa Canyon in southeast Arizona. This paper draws heavily on the results of Dr. Schnell's work.

**SPECIES DESCRIPTION**

Systematics

The genus *Buteogallus* is typified by medium to large hawks with broad, rounded wings of moderate length, and a medium lengthed tail (Brown and Amadon 1968). Although investigators differ in their taxonomic breakdown of the genus, five species are currently recognized (AOU 1983, Amadon and Bull 1988). Three, the mangrove black-hawk (*B. subtilis*), common black-hawk (*B. anthracinus*), and greater black-hawk (*B. urubitinga*), are birds with black plumages that are differentiated by size and the amount of white in the tail and rump. The rufous crab-hawk (*B. aequinoctialis*) and savannah hawk (*B. meridionalis*), formerly *Heterospizias meridionalis*, are both generally brown with variable amounts of rufous, especially in the wings.

Three subspecies comprise the common black-hawk (Schnell 1994). The nominate subspecies (*B. a. anthracinus*) is found from the southwestern United States to northern South America (Palmer 1988, Schnell et al. 1988, Schnell 1994). The Cuban black-hawk (*B. a. gundlachii*), endemic to Cuba and Isle of the Pines, was once described as a separate species (Bond 1947, Monroe 1963). The Utila black-hawk (*B. a. utilensis*) is endemic to islands in the Gulf of Honduras (Brown and Amadon 1968).

It has been postulated that *B. anthracinus* and *B. aequinoctialis* comprise a superspecies (Brown and Amadon 1968), possibly including *B. subtilis* and, with specific designation, *B. gundlachii* (Schnell 1994). However, the systematics of the genus remain unclear (Palmer 1988, Schnell 1994) and further investigations of life history, body characteristics, and genetics are necessary to alleviate the confusion. For example, recent analysis of syringeal morphology (Griffiths 1994) suggest that the Savannah hawk (*B. meridionalis*) (Amadon and Bull 1988) is mis-categorized as *Buteogallus*.

Identification

The common black-hawk sexes are difficult to distinguish morphologically. Adult plumage is a uniform slate-black with a glaucous cast to the neck, back, and breast (Friedman 1950, Schnell 1979), but worn plumage may have a brownish tinge (Brown and Amadon 1968). Feathers on the back of the crown and nape are white basally; the under and upper tail coverts may be tipped with white (Palmer 1988, CWB). The black tail has a single broad

(30-80mm) white band across it, a narrow white terminal band, and varying degrees of white mottling at the base (Friedmann 1950, Brown and Amadon 1968, Schnell 1979). The inner webs of the primaries and secondaries are usually mottled gray to buffy brown (Friedmann 1950, Schnell 1994), especially at the base of the anterior primaries. The cere and basal half of the bill is yellow, the terminal half is black, the iris is dark brown, and the tarsi and toes are yellow (Friedmann 1950).

Juvenile plumage is dark brown and buff overall, typically dark fuscous brown dorsally streaked with buff and cinnamon. The feathers on the breast and throat are yellowish-tan with dark fuscous or blackish tear-shaped streaks (Friedmann 1950, Schnell 1979, Palmer 1988). The rectrices are white to light cinnamon with five to seven dark brown to black bands; the primaries and secondaries are dark with indistinct dark fuscous barring (Friedmann 1950). The cere and basal half of the bill is yellow to greenish-yellow and the terminal half is black, the iris is brown, and the tarsi and toes are dull greenish-yellow (Friedmann 1950). The head has dark brown on the crown and nape with broad buffy white streaks, a falcon-like malar streak, and a white to yellowish chin and throat.

Perched, the black-hawk is almost indistinguishable from the zone-tailed hawk (*Buteo albonotatus*), but the single white tail band is visible dorsally in black-hawks whereas the multiple white tail bands in zone-tailed hawks appear gray dorsally (Bohl and Traylor 1958, Palmer 1988). The black-hawk is very

distinctive in flight because its wings are proportionally broader than typical buteos (Schnell 1994). It often flies with its tail fully-fanned, with slow wing-beats, or soars and glides on horizontally flattend wings. In adults, the white tail band is nearly aligned with the trailing edge of the wings (Schnell 1994) and a light coloration at the base of the primaries may be visible as a "window". In contrast, the zone-tailed hawk flies with a strong dihedral on long, narrow wings, and a longer, multi-banded tail.

Measurements

Many falconiformes exhibit reversed sexual size dimorphism to a degree that facilitates sexing of individuals by measurements. The dimorphism among common black-hawks is slight (Snyder and Wiley 1976), and measures overlap. Taking measurements from individuals across the species range (Friedmann 1950) may be cause for wide variation in the reported morphometrics for the species. Also, there is a possibility of a clinal decrease in size and degree of dimorphism at the northern extent of the species range. Hartman (1961) reported mean weights for male and female black-hawks in Panama as 793+95.8 g ($n$=6) and 1,199±142 g ($n$=4), respectively. A female taken in Campeche, Mexico, weighed 945 g. (Brown and Amadon 1968). In Arizona, weight differences between color banded birds that were behaviorally sexed were less than 100.0 g [males $\bar{x}$=703.4, SE=4.6, ($n$=4); females $\bar{x}$=791.4, SE=6.3, ($n$=2)] (CWB).

**DISTRIBUTION**

Historical - migratory population

Little information is available on the distribution and abundance of common black-hawks in the southwestern U.S. and northern Mexico prior to the 1970's. The extensive loss and alteration of riparian habitat during the early and mid-1900's suggests that the number of nesting common black-hawks has declined throughout the species range in the southwestern U.S. (Hubbard 1965, Snyder and Snyder 1975, Porter and White 1977, Schnell 1994). Common black-hawks nesting in Texas along the lower Rio Grande were virtually eliminated in the early 1900's, probably due to wood cutting (Oberholser 1974). The species also is known to have declined in Tamaulipas, Mexico, after 1958 (Oberholser 1974).

Current - migrant

With rare exception, only migratorial breeding common black-hawks are found in the southwestern U.S. and northern Mexico (Phillips et al. 1964, G. Lasley in Schnell 1994, Schnell 1994). In the United States, the species is found in Arizona, New Mexico, Texas, and Utah. The nesting distribution is patchy due to a scarcity of suitable riparian areas across a generally arid landscape. The majority of breeding common black-hawks in the U.S. are found in Arizona and New Mexico (Schnell et al. 1988), primarily along the tributaries and main streams of the Bill Williams watershed and the Virgin River in northwest Arizona, the streams draining the Mogollon rim of central Arizona, especially

the tributaries and main streams of the Salt and Verde River drainages, and the upper tributaries and main streams in the Gila River drainage in east Arizona and west New Mexico (Schnell et al. 1988, T. McBride, unpubl. data, S. Schwartz, unpubl. data).

A compilation of nesting records from states within the summer range of common black-hawks indicates 186 known nest territories in Arizona (81%), New Mexico (19%), and Utah (>1%), with possibly 10 more in Texas. The majority of the known common black-hawk territories in the U.S. are in Arizona (*n*=150) (Table 1), with nesting birds concentrated in the tributaries of the upper Gila River (Bonita Creek, Eagle Creek, San Francisco River), Aravaipa Canyon, the upper Verde River and its tributaries, and the Burro Creek area in the Bill Williams drainage. The largest number of territories in Arizona are in Yavapai County (*n*=48, 33%). The USDA Forest Service manages lands with the greatest number of territories (Table 1), with the majority of territories occuring in the Clifton Ranger District of the Gila National Forest (Appendices 3, 4). Common black-hawk territories on lands managed by the Bureau of Land Management (Table 1) primarily occur in the Kingman and Gila Resource Areas (Appendices 3, 4). Fewer numbers of common black-hawks nest on lands under the jurisdiction of the Arizona State Land Department, The Nature Conservancy, the Bureau of Indian Affairs, and the National Park Service (Table 1). About one quarter of all known nest territories in the southwestern U.S. are on private land (Table 1).

Table 1. Distribution of black-hawk nests in Arizona (150), New Mexico (35) and Utah (1) on basis of land ownership.

| Land ownership | n | % AZ | % NM | % UT | % Tot. |
|---|---|---|---|---|---|
| U.S. Forest Service | 71 | 31.7 | 6.5 | 0.0 | 38.2 |
| Private Ownership | 46 | 13.4 | 10.8 | 0.5 | 24.7 |
| U.S. Bureau Land Management | 38 | 19.9 | 0.5 | 0.0 | 20.4 |
| State Land Department | 12 | 6.5 | 0.0 | 0.0 | 6.5 |
| The Nature Conservancy | 11 | 4.8 | 1.1 | 0.0 | 5.9 |
| Bureau Indian Affairs | 6 | 3.2 | 0.0 | 0.0 | 3.2 |
| National Park Service | 2 | 1.1 | 0.0 | 0.0 | 1.1 |
| Total | 186 | 80.6 | 18.9 | 0.5 | 100.0 |

The majority of the 35 black-hawk nests in New Mexico are located in the Gila, San Francisco, and Mimbres River drainages in the southwestern part of the state, but one nest occurs within the city limits of Albuquerque (T. McBride, unpubl. data).

Although one or two nesting pairs of common black-hawks have been reported along the Virgin River in Washington County, Utah, (Carter and Wauer 1965, Wauer and Russel 1967, Behle et al. 1985), there are no nest-location records in the Utah Department of Natural Resources heritage database (K. Robinette, pers. commun.). However, one nest has been verified and occurs on private property (S. Hedges, pers. commun.).

As many as 10 common black-hawk pairs are suspected to be nesting in Texas (D. Scott, pers. commun.) in the Davis Mountains of Jeff Davis County (Porter and White 1977, Schnell 1994), and other nesting attempts have been noted in the lower Rio Grande

valley (Webster 1976) and in Val Verde County (Lasley and Sexton 1988). Other sightings in Texas include Big Bend National Park (Williams 1982), the Guadalupe Mountains (G. Lasley in Schnell 1994), and Lubbock County (Williams 1982).

Migratorial common black-hawks in northern Mexico are found in areas with similar habitat features as those in Arizona and New Mexico (Stager 1954, Rodriguez-Estrella and Brown 1990, P. Warren, pers. commun.). Common black-hawks are the most abundant nesting raptor along the Rio Bavispe and Rio Yaqui (29-31 pairs in a 145 km reach) in northern Sonora (Rodriguez-Estrella and Brown 1990) and are considered common in southwestern Chihuahua (Stager 1954).

Common black-hawks are occassionally sighted and documented outside of their breeding/wintering range. A female collided with a vehicle in Bemidji, Minnesota (Elwell et al. 1978). Occassional sightings in southern Florida are possibly vagrant Cuban black-hawks (*B. gundlachii*) (Abramson 1976), or escaped captive birds (Millsap in Robertson and Woolfenden 1992). Several independent sightings have been made in western states (see Schnell 1994 for review).

Winter range information for common black-hawks is sparse. Though Christmas birds counts were sometimes sporadic, a review of those conducted from 1975 through 1994 may provide some insight into wintering range. On the eastern coast of Mexico, common black-hawks were rarely observed in the Mexican state of Tamaulipus, but were frequently observed further south in the

state of Vera Cruz (Table 2). On the western coast they were rarely observed in Sonora but were frequently found further south in Nayarit (Table 2). The state of Nayarit is adjacent to, and due south of, Durango, the only location from which a common black-hawk banded in the U.S. has been reported (Schnell 1994). This suggests Nayarit and the adjacent region may be the best area from which to initiate searches for wintering common black-hawks banded in the U.S.

Table 2. Common black-hawks observed During Christmas bird counts in the Mexican states of Sonora, Nayarit, Tamaulipus, and Vera Cruz, from 1975-94.

| Location | years | $\bar{x}$ | SE | Range | $\bar{x}$ birds/ obs. hr. | SE |
|---|---|---|---|---|---|---|
| Sonora | 16 | 1.9 | 0.37 | 0 - 6 | 0.069 | 0.013 |
| Nayarit | 17 | 5.8 | 0.95 | 1 - 18 | 0.078 | 0.012 |
| Tamaulipus | 16 | 1.2 | 0.32 | 0 - 4 | 0.031 | 0.010 |
| Vera Cruz | 10 | 6.4 | 1.28 | 1 - 15 | 0.097 | 0.032 |

<u>Current and Historic - resident</u>

The common black-hawk is resident in coastal areas of southern Mexico, along the coastal areas of the Central American isthmus (Ridgley and Gwynne 1989) and eastward along the coastal areas of northern South America to Guyana (Schnell 1994), including the islands of Tobago and Trinidad (ffrench 1991).

Resident common black-hawks are similar to migraory individuals in that they are generally associated with aquatic systems. Information on the distribution of the species is incomplete for most of the resident range. Common black-hawks were rarely observed by researchers in Tecal, Guatemala, though greater black-hawks were abundant (D. Whitaker, pers. commun.). Thomas (1908) considered the common black-hawk as the most abundant hawk in Honduras, and Howell and Webb (1995) report it is still common to fairly common. Dickey and van Rossem (1938) found the common black-hawk to be more common and more wide spread than the mangrove black-hawk in El Salvador. Howell and Webb (1995) also suggest the common black-hawk is common to fairly common in El Salvador. However, El Salvadoran biologists consider the common black-hawk rare and the mangrove black-hawk as the more numerous of the two species (M. Cristales, pers. commun.). Common black-hawks are locally common along both coasts of Costa Rica, but are rarely found inland (C. Willie, pers. commun.). The species was common along interior rivers of Panama in addition to coastal areas of mangroves and swampy woodlands (Wetmore 1965). More recently they are reported as fairly common along the Caribbean coast, but ranging inland to some extent along rivers (Ridgely and Gwynne 1989).

**HABITAT ASSOCIATIONS**

The common black-hawk is associated with aquatic systems throughout its range. They are found year round in woodlands, scrub, and mangroves bordering swamps, streams, lagoons, beaches

and mudflats (Dickey an van Rossem 1938, Slud 1964, Wetmore 1965, Monroe 1968, Palmer 1988, Ridgley and Gwynne 1989). Crabs are a primary food source and may be a critical component of suitable habitat in much of the Central American range. For example, their distribution in Panama appears to be dictated by the presence of crabs (Wetmore 1965). In Belize, however, common black-hawks have been observed in the upland interface of pine savannah and hardwoods, often some distance from water (D. Petit, pers. commun.).

In the southwestern U.S., the common black-hawk is an "obligate riparian nester." It is generally dependent on mature broadleaf trees along perennial streams for nest sites (Porter and White 1977, Schnell et al. 1988), although a few nests are situated along intermittent watercourses where small impoundments may persist through the breeding season (Schnell et al. 1988). A reliable supply of riparian associated vertebrate and invertebrate prey also are required for successful nesting (Snyder in Murphy 1978, Millsap 1981). Its nesting territories are restricted to, and disjunct within, riparian communities (Millsap 1981). Riparian communities in which the species is found include the cottonwood-willow series (1224.53) of the Sonoran Riparian Deciduous Forest (<1,200 m elev.), the cottonwood-willow series (1223.21) and mixed broadleaf series (1223.22) of the Interior Southwestern Riparian Deciduous Forest (1,100-1,800 m elev.), and the cottonwood-willow series (1222.31) and mixed broadleaf series (1222.32) of the Rocky Mountain

Riparian Deciduous Forest (1,700-2,300 m elev.) (classifications from Brown et al. 1980). Further habitat descriptions below relate to migrant range only.

Foraging Habitat

Quantitative descriptions of the environments in which common black-hawks forage are lacking. They are generally characterized, however, as areas with surface water less than 30 cm deep interspersed with riffles, runs, and pools (Schnell et al. 1988). Low branches, downed trees, exposed roots, and prominent rocks are important for hunting perches (Schnell et al. 1988, Snyder and Snyder 1991). Aquatic vertebrates and reptiles form the majority of the common black-hawks diet (Millsap 1981, Schnell 1994, Glinski and Ohmart in Schnell 1994), but a diverse array of prey species may be a necessary component of suitable habitat. Millsap (1981) found common black-hawks were absent from areas that supported one taxon of known prey but lacked others.

Nest Habitat

Quantitative descriptions of the environment in which common black-hawks nest are rare. General descriptions of nest sites suggest that nests are typically situated in relatively isolated groves rather than single trees (Millsap 1981, Schnell et al. 1988). Millsap (1981) found large trees and high tree densities characterized common black-hawk nest sites in cottonwood-willow communities. Cottonwoods (*Populus* spp.) (79%) and sycamore (*Platanus wrightii*) (11%) are the predominant tree species used

for nests in Arizona and New Mexico (Millsap 1981, Schnell 1994, Scovill 1995). Other species of trees used as nest sites include alder (*Alanus oblongifolia*), ash (*Fraxinus velutina*), Arizona walnut (*Juglans major*) Goodding willow (*Salix gooddingi*), emory oak (*Quercus emoryi*), ponderosa pine (*Pinus ponderosa*), Douglas fir (*Pseudosuga menziesii*), and mesquite (*Prosopis* spp.) (Bent 1937, Millsap 1981, Glinski in Schnell 1994, Scoville 1995). Along the Rio Yaqui in Sonora, Mexico, the most common nest trees are mesquite and *Pithecellobium* (Roderigueq-Estrella and Brown et al. 1990). Elswhere in Mexico, nests are placed in mangroves, higo (*Opuntia* spp.), higuera (*Ficus* spp.), cottonwood, and cypress (Johnsgard 1990). Cliff-nesting by the species is rare (Fowler 1903, Brown in Schnell 1994).

Table 3 . Nest height, nest tree dbh, and distantance from nest tree to closest water source at black-hawk nests in Arizona. All measures in meters.

| Study | n | Nest height | Tree dbh | Distance to H2O |
|---|---|---|---|---|
| Schnell et al. 1988 *Aravaipa Canyon* | 55 | 18.2 | 1.15 | 38.2[1] |
| Millsap 1981 *Westcentral Arizona* | 24 | 15.3 | 0.72 | - |
| Scoville 1995 *Southeast Arizona* | 33 | 18.9 | 0.94 | 24.3[2] |

1 Schnell and Millsap data combined in Schnell et al. 1988.
2 Data from Scoville 1995 as calculated by CWB.

Stick platform nests are usually built ≥15 m above ground in large, mature trees that are close to surface water (Table 3). The nests are usually constructed in a crotch of the main trunk but are occassionally built on side branches. Old nests are often rebuilt, and nests of other species [Cooper's hawk (*Accipiter cooperii*), Zone-tailed hawk] may be used (Schnell 1994). Schnell (1994) found daily direct exposure to sunlight was 4-20% among nests, however, nests in dead sections of tree have little protection from the sun. No other nest microclimate information is available.

**HOME RANGE and TERRITORIALITY**

Home ranges of raptorial birds tend to depend on habitat quality, the age and experience of individual birds, and their immediate requirements for food which are greatest when feeding nestlings (Newton 1979). One of the most reliable methods of determining home range is through radio telemetry. No telemetry data are available for common black-hawks, and information on home range is limited to inferences made from accumulated visual observations. Thus, the size of home ranges of common black-hawks may be underestimated. For example, primary foraging areas are thought to be in the riparian corridors (Schnell 1979, Millsap 1981, Snyder and Snyder 1991), but individual common black-hawks frequently are observed soaring up and out of riparian canyons, disappearing from sight as they move perpendicularly away from the corridor (J. Schnell, pers. commun., CWB). Such flights may be foraging forays or

territorial displays. Due to the geographic structure of many riparian areas, visually tracking common black-hawks on such forays is nearly impossible. In areas with broader valley floors, such as the Verde River in Arizona, such flights may be more easily observed and monitored, but no detailed observations of common black-hawks have been reported from this area.

Territories are those areas within the home range that are defended against conspecifics. Black-hawk nest territories are irregularly spaced along riparian corridors (Millsap 1981, Schnell 1994). Observations by Schnell (1994) suggest territories do not typically abut, but he found one situation in which two active nests were within 355 m of each other. Nesting densities have been reported as 0.33/km of stream in northern Sonora (Roderiguez-Estrella and Brown 1991), 0.4/km of stream at Aravaipa Canyon, Arizona (Schnell 1994), and 1.3/$km^2$ in westcentral Arizona (Millsap 1981). Other than Millsap (1981), these measures are in river kilometers, so straight distances between territories may be less in areas with meandering waterways.

The amount of area a hawk will range over often correlates with the abundance and proximity of prey (Newton 1979). Thus, areas with low common black-hawk nesting densities may have less abundant prey, or local stream features prevent successful foraging. Low nest densities also may result from a lack of woodland stands with suitable nest trees.

**VOCALIZATIONS**

Common black-hawks communicate with an array of vocalizations (Schnell 1994). Contradictory descriptions of the common call (Palmer 1988) may be due to descriptions from different parts of the range (Stiles and Skutch 1989), different or abbreviated calls, or the unusual complexity of the call (Schnell 1994). Schnell (1994) used sonograms to more clearly analyze the vocal patterns of black-hawks. The common call in the southwest consists of a series of 8-14 high-pitched, whistle-like notes. The series of notes increases in speed and intensity, the third through fifth notes being highest in frequency, then decreases. The common call is used in nest defense, territoriality, courtship, and possibly recognition (Schnell 1994). Variations in call parameters (i.e., pitch, intensity) may communicate different intents.

Other vocalizations include the copulation call, the food call, and the nestling distress call. The copulation call is a monotone series of notes (*whe whe whe whe*, etc.) lasting approximately 10 seconds while copulation occurs (Schnell 1994). The food call, given when hungry, consists of a pattern of 1 to a series of continuous, monotonous notes having a wheezy yet whistle like quality: *wheee wheee wheee wheee*, etc. The nestling distress scream is a loud, high-pitched, buteo-like scream that gives the impression of panic (i.e., *wheeeeeeeee*). It is given when the nestlings are distressed, such as when the nest tree is being climbed by researchers.

**PAIR BOND**

Limited banding and observational data suggest the species is monogamous. Schnell (1994) used an unusual behavioral trait and a unique plumage pattern to determine that the same male and female returned to their territory for possibly 5 and at least 3 years, respectively. A pair banded in 1992 returned to the same territory for 3 consecutive years, and three males, banded in 1993, returned to the same territories for 2 consecutive years (CWB).

Pair formation in raptors is usually associated with nesting territories. Schnell (1994) suggested that pair bonding is initiated during spring courtship displays and by vocalizations in the vicinity of the nest. This seems likely and follows the general pattern for most raptors. However, the behavior of common black-hawks during the non-breeding season is undescribed and there is evidence that pairs of some species maintain the bond through the non-breeding season (see Newton 1979 for review).

**ANNUAL CYCLE**

Understanding the annual cycle of the common black-hawk is essential for determining when projects and activities may cause the greatest disturbance. There are two main periods within the annual cycle; the breeding and non-breeding periods. Within the breeding period are several stages. The timing and duration of each stage is especially important information from a management perspective.

## BREEDING

The age of first breeding has yet to be determined for common black-hawks (Schnell 1994). Among many raptoral species it is not uncommon for a few individuals within a population, especially females, to breed as second year birds (the summer following hatching) (Newton 1979). Breeding by subadult common black-hawks has not been reported, but Schnell (pers. commun.) has observed subadults participate in courtship displays. Common black-hawks probably follow the same pattern as most similar-sized raptors and begin breeding during the second summer following hatching. The following information is from Schnell (1994) unless otherwise specified.

Prelaying Stage (duration variable)

The prelaying period includes the initial courtship and pairing of individuals. In the southwestern U.S., males typically arrive on their territories from early to mid-March (Millsap 1981, Schnell et al. 1988) to early April (Gifford 1985). Aerial displays and vocalizations indicative of territory possession and courtship commence upon arrival, and involve undulating flights, leg dangling, and maneuvers such as dives and stalls (Schnell et al. 1988). Males also court females by bringing prey and carrying sticks over the nest area. Activities of pair members become progressively closer to the nest site prior to construction (J. Schnell, pers. commun.). Nest building/rebuilding by both sexes begins in late March and continues through mid-April.

Copulations commence during nest construction, and take place in the vicinity of the nest site on a branch or rock, and continue until clutches are set.

<u>Laying Stage</u> (1-5 days)

Clutches are typically set in mid-April but may be delayed up to two months. Laying each egg usually occurs over two day intervals. Clutch sizes are normally one or two eggs [($\bar{x}$=1.65 (Schnell 1994) $\bar{x}$=1.93 (Millsap 1981)] though clutches of three have been reported (Bent 1937). There is no evidence the species has more than one brood per season, but a pair may successfully renest if their nest is abandoned or robbed (Thomas 1908, Schnell 1994).

<u>Incubation Stage</u> (37-40 days)

Incubation begins with the laying of the first egg, after which the clutch is rarely left unattended for more than a few minutes. Both sexes share incubation duties, but females always incubate at night (J. Schnell, pers. commun.).

<u>Nestling Stage</u> (46$\pm$5 days)

Mean date of hatching in Arizona is 23 May. Downy nestlings are unique in that they have a prominant dark eye-patch (Schnell 1979). At 3 days the nestlings are mobile enough to defecate over the nest rim. Only the adult female broods nestlings, continuously at first, then for progressively less time during daylight from approximately 8 days of age onwards; she broods nestlings at night until nestlings are 29 days old.

Females do most of the feeding of nestlings and also begin

hunting when nestlings are 15 days old. Nestlings 33 days or older may begin moving out onto branches adjacent to the nest. Older nestlings and "branchers" may be able to feed themselves, but the adult female continues doing so most of the time.

Fledgling Stage (approx. 46 days)

Mean date of fledging is 8 July. Fledglings are fully feathered but dependent upon adults for food until approximately 110 days of age. They tend to remain in the nest territory until the onset of migration.

NON-BREEDING

There is no information on the life history of migrant common black-hawks on their winter range, and the location of the winter range for U.S. migrants is unknown (Schnell 1979). Murphy (1978) speculated that the winter range for U.S. migrants was in Central America, but the only return of a migrant bird banded in the U.S. was from Durango, Mexico (Schnell 1994).

**MOVEMENTS**

Long distance movements beyond a territory are of two types: migration and dispersal. Migrations are seasonal movements between summer (breeding) and winter (non-breeding) ranges, and may be related to movements along latitudinal or elevational gradients. Natal dispersal is the movement of juveniles from their natal territory to an area where they may establish their own territory (Greenwood 1980). Occassionally, adults may be displaced from their nesting territory by habitat disturbance or alteration. Breeding dispersal occurs when these displaced

adults seek out new territories (Verner et al. 1992).

MIGRATION

Common black-hawks are migratory only in the northern portions of their range, though winter sightings have been reported in the lower Rio Grande valley (G. Lasley in Schnell 1994), southern Arizona (Phillips et al. 1964), and northern Sonora (P. Warren, pers. commun.). Little information is available on migration routes, distances moved, winter range (but see Distribution: current - migrant) and behavior of migrant common black-hawks. Typically, common black-hawks arrive on their breeding grounds from early March through early April. As with most migratorial raptor populations (Newton 1979), males tend to arrive on the breeding grounds first. Earliest records of arrival are 5 March for Arizona (Aravaipa Canyon, Schnell et al. 1988), 1 April for Texas (Jeff Davis Co., Espy in Schnell 1979), and 3 April for Utah (Springdale, Gifford 1985). The latest autumn sighting is 24 October at Aravaipa Canyon (Schnell et al. 1988). One individual banded in southeast Arizona was recovered in early January in Durango, Mexico (Schnell 1994), which suggests the bird was on wintering grounds approximately 965 km south of its natal area.

Common black-hawks are generally believed to migrate solitarily along riparian corridors, but southern migrants have been observed along high mountain ridgelines in southeast Arizona (Snyder and Snyder 1991), and spring and autumn migrants have been observed in Tucson on several occassions (J. Dawson, pers.

commun., CWB). Migrants observed in the lower Colorado River valley are believed to have followed drainages down from the Virgin (Utah) and Big Sandy (Arizona) rivers (Rosenberg et al. 1991). There is no available migration information on black-hawks in New Mexico and Texas, but it is likely the New Mexico birds follow similar physiographic features as those from south-east Arizona.

DISPERSAL

Dispersal is essential for replacing the loss of adult breeding birds. Information on disperal abilities and tendencies may be critical to habitat management plans. There is currently no information on dispersal for common black-hawks.

**MORTALITY**

Mortality of even well studied species is difficult to document because dead animals are seldom located. The agents and rates of mortality among relatively un-studied species, such as the common black-hawk, are even more difficult to determine. Still, some agents are known and others can be assumed, but the rate of mortality for common black-hawks is unknown.

<u>Human Related</u>

Electrocution is a frequent agent of mortality among raptors (Olendorff et al. 1981). One common black-hawk is known to have been electrocuted on a power pole (Schnell 1994), but it is probably a rare occurrence as most territories are unlikely to have power lines nearby. Electrocutions may become a greater concern as riparian areas are encroached upon by human

developments. Additionally, it may be a common mortality factor during migration or on wintering grounds.

Disturbances near nests by recreationists have caused nesting failure, nest abandonment, and pre-mature fledging with subsequent death (Schnell 1994). Adult birds tend to remain close to their nest when approached by humans, increasing their vulnerability to shooting. Nesting common black-hawks have been shot (Snyder and Snyder 1991), and such persecution may occur more frequently than the evidence indicates (A. Bamman, pers. commun.). Shooting may be a significant mortality agent on the wintering ranges; reports suggest raptor persecution is common throughout much of Latin America (D. Petit, pers. commun.; C. Willie, pers. commun.; M. Cristales, pers. commun.).

Predation

Predation of nestling raptors by arboreal mammals such as raccoons (*Procyon lotor*) is common. In the southwestern U.S. and northern Mexico, nests may also be robbed by coatis (*Nasua nasua*) and ringtails (*Bassariscus astutus*). The great horned owl (*Bubo virginianus*) is a common predator of nestlings, and sometimes adult, raptors. The predation of an adult common black-hawk by a golden eagle (*Aquila chrysaetos*) (S. Morgan, pers. commun.) is probably a rare occurrence.

Agonistic Interactions

Inter and intra-specific agonistic interactions may result in mortalities of adults. Two common black-hawks were observed binding to each other in flight, falling to the ground, then

continuing to fight until flushed by the observor (Schnell in Palmer 1988). A peregrine falcon (*Falco peregrinus*) was observed stricking a common black-hawk in mid-air (Terry Myers, pers. commun.). Encounters with resident red-tailed hawks (*Buteo jamaicensis*) may be intense but contact is rare (Schnell 1994). Still, some incidents may lead to occassional mortality. The apparent predation of a common black-hawk by a red-tailed hawk (Schnell 1994) may have been carnivory following a particularly aggressive territorial encounter.

Disease and Parasites

There is no information on what diseases and parasites affect common black-hawks or how detrimental they may be.

**COMPETITION**

No information is available on the dynamics of raptor communities within southwestern riparian systems. Predation on avian and mammalian prey suggest competition may occur between common black-hawks and other raptors that inhabit the same areas. Competition may be reduced by common black-hawks preying primarily on aquatic vertebrates. Other piscivorous raptors, the osprey (*Pandion haliaetus*) and the bald eagle (*Haliaeetus leucocephalus*), seldom occupy the same habitats. Direct competition is more likely to occur by other piscivorous birds such as the great blue heron (*Ardea ardea*), green heron (*Butorides striatus*), and possibly the belted kingfisher (*Ceryle alcyon*). Principal mammalian competitors are likely to be raccoons and, where they occur, river otters (*Lutra canadensis*).

Red-tailed hawks, zone-tailed hawks, and gray hawks (*Buteo nitidus*) occupying the same areas may compete with common black-hawks for nest sites, and great horned owls may usurp old nests.

## DIETS

### Prey Capture

Common black-hawks opportunistically select the most available prey in riparian communities (Schnell 1994). They are generally sit and wait predators, perching on a low branch, rock, or occassionally a sandbar, then making short swooping or pouncing capture attempts when a prey item is detected (Schnell 1979, CWB). They occassionally forage by wading into water to stalk prey (Schnell 1979), and one wading bird was observed waving its wings in the water in a possible attempt to herd or concentrate prey (Millsap in Palmer 1988). Common black-hawks occassionally are more active in their search and capture of prey. Schnell (1979) observed a common black-hawk capture a hooded oriole (*Icterus cucullatus*) in flight, and CWB observed a common black-hawk in flight capture a tropical kingbird (*Tyrannus melancholicus*) from a mist net.

The recognition of prey and associating prey with water may be at least partly innate. An abandoned common black-hawk nestling taken into captivity prior to gaining foraging experience was repeatedly observed perching on the rim of a large water pan and apparently searching the water for prey (CWB). Later, the young hawk showed no hesitation in capturing goldfish placed in the pan.

Diet Composition

Aquatic vertebrates account for most of the common black-hawks diet, but reptiles and birds may constitute a substantial portion of the diet in some areas (Glinski and Ohmart in Schnell 1994) (Appendix 1, 2). Diets also fluctuate from season to season as prey availability changes (Schnell 1994). Among vertebrate prey, at least eight species of fish, four species of amphibians, 14 species of reptiles, 12 species of birds, and seven species of mammals have been identified as black-hawk prey (Appendix 1).

Carrion has been reported as an occassional food source for common black-hawks (Slud 1964, Carter and Wauer 1965, Abramson 1976). The species also will cache and use cached prey, especially when it is too large to be consumed by nestlings in one feeding (Schnell 1979, Millsap and Harrison in Schnell 1994, Schnell 1994). Little information is available on caching behavior of predatory birds in general (Collopy 1977, Carlson 1985), but it may be a significant factor in optimizing food in areas or times of limited resources.

Energetics

No information is available on feeding rates, dietary nutrition, or energetic requirements for free-ranging adult or nestling common black-hawks.

**POPULATION STATUS AND TRENDS**

The migrant common black-hawk population apparently is limited by the availability of suitable riparian habitat. The

migrant population is thought to be self-sustaining (Snyder and Snyder 1991, Schnell 1994). Estimates of historic population size for migrant common black-hawks are not available; most historical information is in anectdotal form. A survey in the mid-1970's suggest 220-250 pairs of common black-hawks nest in the southwestern U.S. (Schnell et. al. 1988). Currently, 183 nest territories are known in Arizona, New Mexico, and Utah, and as many as 10 territories may be in Texas. Most of the available information is occupancy data only and has been collected sporadically. Long term monitoring at Aravaipa Canyon, Arizona (Schnell 1994) and an increase from 3-4 territories to 9 territories along Bonita Creek, Arizona (A. Bamman, pers. commun.) suggests that the population is at least stable. However, Aravaipa Canyon and Bonita Creek are protected areas with sub-populations of the migrant common black-hawk population; extrapolations of trends in these areas to the entire population may not be valid.

Common black-hawks have a low reproductive rate compared to other similar sized buteos (Schnell in Newton 1979, Millsap 1981, Schnell 1994). Clutch sizes are reported to range from 1 to 3 (Bent 1937), but Thomas (1908) found only 1 and 2 egg clutches in Belize. Only one clutch of 3 eggs has been reported for the southwestern U.S., and it may have resulted from additions by a known replacement female (Schnell in Palmer 1988). Reported clutch sizes in Arizona are 1.93 and 1.65, with fledging rates of 1.31 and 0.98 (Millsap 1981, Schnell 1994), respectively.

Common black-hawks may have a strong nest site fidelity (Schnell 1994, CWB). Thus, the effects of lower than normal reproduction or nesting failures may not manifest for several years, especially if nest monitoring continues to be sporadic.

The lack of quantitative information on nesting success, longevity, turn-over rates, recruitment, winter range and basic life history critically impair any attempt to determine the status of the migrant common black-hawks. At this point in time, with the limited infomation available, the species appears to be stable. The rehabilitation and protection of many riparian areas has made the common black-hawk population more secure, but it is at risk of a reversal of such management policies. Further degredation of riparian habitat would be detrimental to the species and place the population at increased risk.

**LEGAL STATUS**

The common black-hawk is not on the federal endangered species list (ESA), nor is it currently under consideration. The U.S. Forest Service (USFS) classifies it as a sensitive species. The Bureau of Land Management (BLM) does not have a categorical system for classifying species of special concern. Though the black-hawk is tied to aquatic systems in Arizona, it is not included in the Arizona Department of Water Resources (ADWR) habitat management plan. Unless a species is federally listed under the ESA and the habitat is defined, it has low priority for management consideration by the ADWR (C. Harris, pers. commun.). At the state level, the black-hawk is considered a candidate

species for listing in Arizona (Arizona Game and Fish Department 1988), a threatened species in New Mexico (New Mexico Department of Game and Fish 1988) and Texas (D. Scott, pers. commun.), but receives no special status or protection in Utah (K. Robinette, pers. commun.).

The common black-hawk gained protection in the United States and Mexico when it was added to the Migratory Bird Treaty Act (MBTA) in 1972. The MBTA is contained in 50 CFR 10.13, and is subject to 50 CFR Part 21 which lists regulations governing the take, possession, transport, sale, and purchase of migratory birds. Throughout most of its range, the black-hawk is also protected under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) as a category 2 species, for which trade is restricted but import permits are not required (Bean 1983).

All of the Latin American countries have laws protecting wildlife resources, either directly or indirectly through health-based environmental laws (Swift 1983). Progress has been made in extending the existing laws governing consumptive and commercial uses of wildlife to general wildlife management (Swift 1983). Unfortunately, environmental laws are often ignored and are rarely enforced due to budget constraints and a lack of trained personnel (Swift 1983, M. Carter, pers. commun., M. Cristales, pers. commun., D. Petit, pers. commun., C. Willie, pers. commun.).

**THREATS**

CHANGES IN HABITAT

The main threat facing migrant common black-hawks is the degradation and loss of riparian habitat (Hubbard 1965, Porter and White 1977, Horton 1977, Schnell et al. 1988, Snyder and Snyder 1991, Krueper 1993, Schnell 1994). Loss of riparian environments is usually attributed to livestock grazing, mineral extraction, water diversions for irrigation and storage, diking and damming for flood control, ground water pumping, and clearing to create agricultural lands, (Millsap 1981, LeFranc and Glinski 1988, Schnell et al. 1988).

Livestock grazing

Improper livestock grazing practices can be one of the most damaging factors in riparian areas (Glinski 1977, Marlowe and Pogacnik 1985, Krueper 1993). Grazing can prevent or suppress the regeneration of riparian tree species, resulting in isolated decadent stands with no replacement growth (Carothers 1977). The loss of nest trees by natural mortality and a lack of replacement trees result in decreased nesting opportunities for riparian obligate species (Millsap 1981) and may increase competition between raptors for nest structures.

Heavy grazing may deplete upland grasses, thereby increasing runoff, soil erosion, and channel cutting (Kockert et al. 1988). This can have dramatic impacts on instream and riparian system quality (Kauffman and Krueger 1984). Channelization has been related to population declines of Catastomid suckers and

roundtail chub (Behnke and Raieigh 1979), principle prey for common black-hawks. Further, riparian use by livestock can widen and shallow the streambed and silt in gravel substrates, rendering the areas unsuitable for larger fishes (Millsap 1981).

Grazing can also affect small mammals, birds, and reptiles, both favorably or negatively, depending on the species (Reynolds and Trost 1980, Taylor 1986, Kockert et al. 1988, McAdoo et al. 1989). The affects of grazing on whiptails and earless lizards, important food for common black-hawks in some areas, is not known.

Mineral extraction

All forms of mineral extraction involve disturbance to the landscape (Ramakka 1988). Possible disturbances to common black-hawks associated with mineral extraction are exploration, blasting, operation of heavy equipment, and increased human activities (see Ramakka 1988 for review). Habitat loss due to mines, especially open pit mines used for copper extraction, generally is permanent. Mining activities also have indirect affects on riparian streams (Millsap 1981). Ground water pumping can result in a loss of native trees and promote the growth of salt cedar (Tamarix spp.), a noxious exotic plant (Millsap 1981). Decreased stream flows also may reduce piscine prey. However, water use by mining activities may be beneficial to common black-hawks in some situations. For example, Phelps Dodge Corp. uses Eagle Creek as a channel for water from ground water wells and other surface flow far upstream from where it is removed for

mining uses. Thus the water level in the upstream section of Eagle Creek is maintained because of the need for a constant reliable source of water at the extraction point (H. Snyder, pers. commun.).

Copper and zinc contamination may be responsible for poor reproduction of black-hawks in Boulder and Burro creeks, Arizona (Millsap 1981). The impacts of heavy metal contaminants (e.g., cadmium, copper) on common black-hawks and their habitat has not been adequately evaluated (Millsap 1981, Cain 1988, LeFranc and Glinski 1988).

Agriculture

Clearing or altering riparian areas for conversion to agriculture is detrimental to common black-hawks and their prey. The removal of gallery forests deprives common black-hawks of nesting habitat. Water diversions for agricultural/industrial uses are present in many streams with nesting common black-hawks (Burton 1988). Pumping and diverting water for irrigation decreases surface water, is deleterious to black-hawk prey (Schnell et al. 1988), and favors invasion by salt cedar (Millsap 1981).

The effects of agricultural contaminants on riparian ecosystems have not been adequately evaluted (Cain 1988, LeFranc and Glinski 1988, Schnell et al. 1988, Inigo-Elias et al. 1991). Organochlorine pesticides (e.g., DDT) are no longer used in the U.S., but are commonly used throughout the resident and winter ranges of common black-hawks. Organophosphate pesticides are

used in the southwest, and secondary poisoning of raptors eating poisoned prey has been documented (Balcomb 1983, Henny et al. 1985). Organophosphates break down within a few months of application (Cain 1988), but bullfrog (*Rana catesbeiana*) tadpoles were found to concentrate organophosphates at 60 times the level in water and were lethal to mallards (*Anas platyrhyncos*) (Hall and Kolbe 1980). Common black-hawks may be particularly susceptible to organophosphate poisoning by consuming exposed aquatic prey.

Exotic Species

Riparian areas of the southwest are being invaded by two plant species that are detrimental to riparian ecosystem health. The first, salt cedar or tamarisk, is an invasive species that impedes streamflow, exacerbates flooding, replaces native riparian vegetation, has low value for native wildlife, and has been associated with high water use through evapotranspiration (Carothers 1977, Ohmart et al. 1977, Kunzmann and Johnson 1989). It is especially successful in areas where diversions and dams have modified stream flows (Kerpez and Smith 1987). Eradication attempts are costly but some have proven effective (Krueper 1993).

Water cress (*Nasturtium* spp. or *Rorippa* spp.) is another plant that has been introduced to some streams of the Southwest. It forms dense floating mats of growth on the surface of the water, making foraging areas unsuitable for common black-hawks (Snyder and Snyder 1991). However, it provides cover and

improves reproductive conditions for prey animals such as fish and frogs (J. Schnell, pers. commun.).

Winter Range

Because the winter range of migrant common black-hawks is unknown, perturbations affecting the species during the winter are speculative. Most Latin American countries have not banned the use of organochlorine pesticides, such as DDT, that are known to be detrimental to raptors (Henney et al. 1982, 1984). Rapid growth of human populations also has led to wetlands being drained and polluted with industrial wastes. Most neotropical migrant birds suffering from pollutants are higher trophic level predators (Henny et al. 1982, Rappole et al. 1983). Chemical contamination of riparian areas may have a profound effect on both the wintering and resident common black-hawks and prey species.

Deforestation of woodlands for timber and conversion of woodlands for agriculture and pasture use are chronic problems throughout Latin America (Rappole 1983) and have wide ranging effects on the environment (Myers 1980). As human populations grow, increasing demands placed on the environment will undoubtedly result in further habitat degredation (Rappole 1983). The effects of these activities on common black-hawk habitat likely will be detrimental.

CHANGE IN PREY

Populations of Sonora suckers (*Catastomas insignis*) and desert suckers (*C. clarki*) appear to be stable at present

(Sublette et al. 1990). Roundtail chub (*Gila robusta*) populations are diminishing in most of their range in New Mexico and have been extirpated from some waterways (Sublette et al. 1990). The main subspecies found throughout Arizona and New Mexico is state-listed as a Threatened Species in Arizona (AGFD 1988) and as an Endangered Species in New Mexico (Sublette et al. 1990). Prevalent explanations for decreases in native fishes are competition with introduced species and alteration of habitat.

There is widespread concern about the status of leopard frogs because Ranid populations have undergone declines throughout their range (Hayes and Jennings 1986). Speculations about why Ranid populations have declined include toxicants, acid rain, and competition with and predation by introduced bullfrogs (Clarkson and Rorabaugh 1989). Loss of Ranid populations will negatively affect common black-hawks, but common black-hawks will readily eat bullfrogs when they are in their foraging areas (Glinski and Ohmart in Schnell 1994).

Little information is available on the status of other species upon which the common black-hawk regularly preys. There is evidence that common black-hawks may not nest successfully if limited to one prey species, even if abundant. Millsap (1981) found that common black-hawks did not nest in areas where piscine prey was abundant but amphibian and reptile prey were scarce.

DISTURBANCES

Disturbance to nesting common black-hawks may be in many forms. Disturbances such as fires, timber harvesting in upland

areas, and natural perturbations (i.e., flooding), are likely to have minimal negative impacts. Recreational activities, mining, and land development in riparian areas may result in more profound impacts by increasing human presence near nesting raptors. Additionally, the influx of humans into common black-hawk territories increases the chance of direct persecution.

Development

Most areas that common black-hawks inhabit are remote and at low risk of development (Snyder and Snyder 1991). In some situations black-hawks appear capable of habituating to low levels of human activity. Successful pairs have nested in the vicinity of ranching and mining operations and single residences. Perhaps more interesting is the ability of some pairs to nest in areas of high human use. Common black-hawks have successfully nested for several years within the city limits of Cottonwood, Arizona and Sedona, Arizona (CWB). More recently, a nesting pair has been reported within the city limits of Albuquerque, New Mexico (T. McBride, pers. commun.).

Along with development, however, is an increased risk of mortality factors such as electrocution on power poles, collisions with vehicles, and persecution.

Recreation

Recreational activities in nest territories are problematic for nesting raptors in general (Knight and Skagen 1988, LeFranc and Glinski 1988). Recreational activities may cause adult raptors to abandon their nests, reduce productivity and disrupt

foraging behavior (Fyfe and Olendorff 1976, Knight and Skagen 1988). Several studies have demonstrated that raptors flush from nests upon approach by humans (Fraser et al. 1985, White and Throw 1985). Repeated flushing of raptors may result in increased expenditures of energy spent in foraging, decreased time spent feeding, and increased energy expenditures through avoidance flights (Stalmaster 1983). Flushing raptors from nests also can lead to egg breakage and nestlings being knocked from the nest (Grier and Fyfe 1987). Flushing can also alter parental nest attentivenss, thereby increasing risk of predation and nestling mortality due to exposure (Fyfe and Olendorff 1976).

The landscape features common black-hawks require for nesting are also attractive to recreationists. Many people attempt to escape the summer heat of the southwest desert by hiking and camping in the cool gallery forests along riparian corridors. Thus, the potential impact of recreation on common black-hawks may be greater than that for other species. Though chronic or long-term intrusions can cause nesting failure and territory abandonment, little empirical data addressing human disturbances is available for even common raptors (Knight and Skagen 1988).

Fires

Fires are a distinct possibility in common black-hawk territories, especially due to the high recreational use of riparian areas. Even low intensity fires may kill cottonwoods if sufficient litter is around the base of the tree, and ash will

have detrimental effects on the local aquatic life. Erosion may occur following a fire and can have additional negative impacts on aquatic life. The disjunct nature of black-hawk distribution suggests that wildfires would probably only affect single territories. Natural wildfires and small, human caused, fires will probably also function as normal short term environmental disturbances. Thus, fire is not perceived to be a threat to the common black-hawk at the population level.

Timber Harvest

Timber harvesting does not occur throughout most of the common black-hawks migrant range (see Winter Range), and few common black-hawks nest in trees that are commercially harvested. Negative impacts of timber harvesting are probably more of a concern as a disturbance factor in nest areas. Erosion caused by harvesting in the uplands also could increase sediment loads in streams and negatively affect piscine prey species.

Natural Disturbances

Native species in riparian systems have evolved with periodic natural disturbances such as flash floods and droughts. Schnell (1979) postulated that flash flooding may be an important occurence in common black-hawk habitat, serving to clear streams of algae and water cress that may interfere with foraging success. Floods are also instrumental in creating oxbows and meanders in streambeds. Such features are important for amphibian reproduction and the regeneration of riparian trees. Stream damming by beavers (*Castor canadensis*) may function in a

similar manner, providing habitat for common black-hawk prey species and conditions conducive to tree regenration.

**MANAGEMENT RECOMMENDATIONS**

A primary tenet of species management is to identify and alleviate limiting factors. These factors may be obvious or may be determined through field studies. For a variety of reasons, the development of recommendations to alleviate limiting factors is often relatively easy compared to the actual implementation of the recommendations. Additionally, management must be considered in terms of cumulative effects on the biological and physical attributes of the system (Zube and Simcox 1987). This is an especially important consideration when developing management plans for riparian dependent species since western riparian ecosystems are among the most productive habitats in North America (Krueper 1992). However, the common black-hawk is a riparian obligate species occupying the highest trophic level in many riparian areas. Management favoring common black-hawks should therefore improve overall riparian conditions.

<u>Recommendations</u>

Priority should be given to conserving existing riparian habitats and rehabilitating degredated riparian areas. For example, results of management practices at Burro Creek are becoming manifest, with tree regeneration and improved riparian conditions (R. Hall, pers. commun.). Special attention should be directed at tree regeneration and stream characteristics.

*Tree regeneration*

Remove livestock or build livestock exclosures to protect areas where regeneration of trees is occurring naturally. Keep livestock out of these areas until saplings are established. Where natural regeneration is not occurring, plant cottonwood saplings. Planting layout should be in elongated stands with saplings spaced about 15 to 20 m apart to produce groves. Isolated saplings should be planted in protected locations above the seasonal flood zone. Plantings should be monitored for survival and to determine when livestock grazing may resume. The condition of individual streams should be evaluated for possible modification of grazing allotment plans.

*Stream flow.*

Damming should be restricted in areas where it will cause destruction of riparian habitat. Attempts should be made to incorporate riparian areas into public ownership through land exchanges or purchases. Water rights should be obtained to insure in-stream flow for maintenance of habitat and riparian-dependent species. Water quality should be monitored, especially in relation to contaminants, and enforcement of state and federal regulations should be pursued. Finally, require replacement of riparian habitat lost through water or land projects.

*Prey abundance/availability.*

Manipulate streams and terrestrial components of riparian areas to favor native piscine, amphibian, and reptilian prey. This will require the determination of habitat requirements for

these species. Management for native fishes may require increasing or decreasing stream flows and reducing siltation in spawning areas. Construction of small instream impoundments and pools will concentrate prey species and increase prey availability to foraging by black-hawks. Impoundments and pools should be constructed where shade will be available during afternoon hours, and suitable common black-hawk perches are present. The reintroduction of beavers to areas where they have been extirpated will likely improve stream conditions for aquatic prey. In areas where lizards are important prey, the life history and habitat needs of individual species will need to be addressed.

*Human disturbance.*

Buffers of 0.5 km around nests may be effective in reducing human disturbance during nesting, but common black-hawk nests are often situated such that hikers in riparian corridors cannot avoid them. If disturbance in an area is believed to be high, or if more than one nesting pair would be disturbed, access to the area should be limited or closed from mid-March until the end of June. Most nest disturbances are not caused by malicious behavior, but rather by people unaware of the harm they may be causing. Information signs, off-limits postings, and environmental education, such as visitor information brochures, may significantly decrease nest disturbance. All motor vehicle traffic in riparian areas should be restricted to designated roads only.

*Nest sites.*

Suitable nest structures may be the limiting factor in some areas that would otherwise be suitable for common black-hawks. Artificial nests have proven useful with some species. On a site specific basis, artificial nests may be a valid method of providing interim nest sites for common black-hawks until natural regeneration provides suitable trees.

**RESEARCH & MANAGEMENT PRIORITIES**

A recurrent theme of this assessment is the lack of information available on common black-hawks. The most pressing information needs relate to current population size, distribution, and trends. Listed below are recommended research and monitoring priorities.

1. Identify the wintering range to determine threats incurred by the species during the non-breeding season. Satellite telemetry of a few adult birds (Woodbridge et al.1995) may be the easiest way to obtain this information. Further, contacts should be established with researchers in Latin American countries to facilitate band returns and wintering information.
2. Conduct a systematic survey of a representative sample of historic nest territories distributed across the southwestern U.S. and monitor them annually to determine nest occupancy, productivity, and population trends. Once a baseline dataset is obtained, annual monitoring may be decreased to periodic long term monitoring.

3. Initiate a banding program to determine territory fidelity, recruitment, turn-over rates, dispersal patterns, and wintering range.

4. Initiate research to address basic information needs (e.g., habitat use, nest site physiography).

5. Initiate research programs to acquire information on life histories, habitat requirements, and limiting factors of important common black-hawk prey species for which data is lacking.

6. Continue documentation of new nest sites reported by the public and by personnel in natural resource managment agencies.

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Appendix 1. Prey of the common black-hawk recorded in the southwestern United States and northern Mexico. Reference numbers as follows: 1: Boal unpubl.; 2: Cottam and Knappen 1939; 3: Fowler 1903; 4: Hiraldo et al. 1991; 5: Millsap and Harrison in Schnell 1994; 6: Schnell 1994; 7: Glinski in Sherrod 1978; 8: Van Tyne and Sutton 1937; 9: Wauer 1969. Modified from Schnell 1994.

| Common Name | Scientific Name | Reference |
|---|---|---|
| Invertebrates | | |
| Crayfish | Crustacea | 7,8 |
| Centipede | *Scolopendra* spp. | 5,7,8 |
| Water bug | *Belostomata* spp. | 2 |
| Cicada | *Tibicen* spp. | 5 |
| Dobsonfly (larvae) | *Corydalis cornuta* | 2 |
| Beetle | *Xylosyctes* spp. | 2 |
| Beetle | *Brachinus* spp. | 2 |
| Beetle | *Trichoton sordidum* | 2 |
| Beetle | *Chlaenius cumatilis* | 2 |
| Beetle | Alleculidae | 2 |
| Beetle | Tenebrionidae | 2 |
| Butterfly (larve) | Lepidoptera | 2 |
| Hornworm | Sphingidae | 5,6 |
| Wasp | *Polistes* spp. | 2 |
| Ant | *Pogonomyrmex* spp. | 6 |
| Ant | *Camponotus* spp. | 2 |
| Unidentified | | 4 |
| Fish | | |
| Roundtail chub | *Gila robusta* | 5 |
| Sonora sucker | *Catostomus insignis* | 5,6 |
| Gila sucker | *C. clarki* | 5,6 |
| Rainbow trout | *Salmo gairdnerii* | 1,7 |
| Yellow bullhead | *Ictalurus natalis* | 7 |
| Sunfish | *Lepomis* spp. | 7 |
| Perch | *Perca* spp. | 7 |
| | *Moxostoma austrinum* | 4 |

| | | |
|---|---|---|
| **Amphibians** | | |
| Leopard frog & larva | *Rana pipiens* | 5,6 |
| Canyon tree frog | *Hyla arenicolor* | 5,6 |
| Toads | *Bufo* spp. | 7 |
| Bullfrog | *Rana catesbiena* | 7 |
| Unidentified | | 4 |
| **Reptiles** | | |
| Yellow mud turtle | *Kinosternon flavenscens* | 5 |
| Chuckawalla | *Sauromaius obesus* | 5 |
| Desert spiny lizard | *Sceloporus magister* | 5 |
| Clark's spiny lizard | *S. clarki* | 6 |
| Yarrow's spiny lizard | *S. jarrovi* | 4 |
| | *S.* spp. | 4 |
| Long-tailed bush lizard | *Urosaurus graciosus* | 5 |
| Tree lizard | *U. ornatus* | 5,6 |
| Collared lizard | *Crotaphytus collaris* | 6 |
| Earless lizard | *Holbrookia* spp. | 7 |
| Whiptail | *Cnemidophorus* spp. | 7 |
| West. patch nosed snake | *Salvadora hexalepis* | 5 |
| Black-necked garter snake | *Thamnophus cyrtopsis* | 5 |
| Sonora whip snake | *Masticophus bilineatus* | 6 |
| Snake | *Coluber* spp. | 2 |
| Gopher snake | *Putuophis melanoleucus* | 7 |
| **Birds** | | |
| American kestrel | *Falco sparverius* | 1 |
| Gambel's quail (chick) | *Callipepla gambelii* | 6 |
| Dove (nestling) | Columbidae | 6,7 |
| White-throated swift | *Aeronautes saxatalis* | 6 |
| Gila woodpecker | *Melanerpes uropygialis* | 1 |
| Cassin's kingbird | *Tyrannus vociferans* | 5 |
| Tropical kingbird | *T. melacholicus* | 1 |
| Vireo | *Vireo* spp. | 5 |
| Meadowlark | *Sturnella* spp. | 9 |
| Hooded oriole | *Icterus cucullatus* | 6 |
| Dickcissel (?) | Fringillidae | 2 |
| Green-tailed towhee | *Pipilo chlorurus* | 3 |
| **Mammals** | | |
| Bat | Chiroptera | 5,7 |
| Cottontail rabbit | *Sylvilagus* spp. | 7 |
| Cliff chipmunk | *Eutamias dorsalis* | 6 |
| Rock squirrel | *Spermophillis variegatus* | 5,6 |
| Gopher | *Thomomys* spp. | 6 |
| Mouse | *Peromyscus* spp. | 6,7 |
| White-throated woodrat | *Neotoma albigula* | 6 |

Appendix 2. Natural history of select black-hawk prey species.

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The limited studies conducted on black-hawks indicate a similarity in prey use among the riparian areas in the migrant range. Three native fishes, the desert sucker (*Catostomus clarki*), Sonora sucker (*C. insignis*), and roundtail chub (*Gila robusta*) (Robins et al. 1991), account for 34-35% (Millsap 1981, Schnell 1994) of the prey items in black-hawk diets. Leopard frogs (*Rana* spp.) account for 32% (Millsap 1981) and, combined with canyon tree frogs (*Hyla arenicolor*), 24% (Schnell 1994) of the diet. Further, native fishes and leopard frogs account for 59% and 18% of the prey biomass (Millsap 1981).

Several other species, especially reptiles (Appendix 1) also figure in the diet to a lesser extent. Black-hawks nesting along the Verde River (Glinski in Sherrod 1978, Glinski and Ohmart in Schnell 1994) preyed primarily on reptiles, especially the earless lizards (*Cophosaurus* spp., *Holbrookia* spp.) and whiptails (*Cnemidophorus* spp.), and, to a lesser degree, nestling birds and introduced fishes (Appendix 1).

Here we provide a natural history overview for the important prey species of the black-hawk. If management goals were to increase prey populations or improve prey habitat, it would be necessary to compile a more exhaustive knowledge base on the ecology of the individual prey species. Unfortunately, most of

the prey species black-hawks use are still poorly understood.

FISH

Desert sucker (*Catostomus clarki*)

The desert sucker is a medium sized fish, attaining adult lengths of 100-380+ mm (Sublette et al. 1990). The species has variations in its morphology which has lead to some confusion in classification (Minckley 1973). It is one of the most common larger native fishes of the Colorado Basin (Rinne and Minckley 1991), and occurs in the Virgin River, Bill Williams River and Gila River basins. It is especially common in the Verde River, Salt River and the San Francisco River drainages (Minckley 1973, Sublette et al. 1990). Populations of the species, at least in New Mexico, appear to be stable (Sublette et al. 1990).

Adult desert suckers tend to forage in rapids and flowing pools of streams over a substrate of gravel-rubble. Young congregate along the banks in quiet water, sometimes in large numbers, and move to swifter waters as they mature (Minckley 1973, Sublette et al. 1990). The species is rather sedentary, displaying little seasonal movement despite flooding (Bestgen et al. 1987). They are tolerant of a wide range of water temperatures. In the Virgin River they prefer temperatures of $17.5^0$ C, with a range $10.0$-$21.0^0$ C. However, they appear to have a lower tolerance of reduced oxygen than other native fishes (Sublette et al. 1990).

Desert suckers feed on algae and other materials by scraping them from the surface of rocks with cartilage sheathed jaws

(Minckley 1973, Sublette et al. 1990, Rinne and Minckley 1991). Spawning begins in late winter and early spring. Two males typically pair with a female, taking positions on each side of her in riffles. As the fish agitate the stream bottom, gametes are emitted and the fertilized eggs fall into the interstices of the gravel substrate to develop.

**Sonora sucker** (*C. insignis*):

The Sonora sucker is a large fish, attaining adult lengths of 300-2,000 mm (Minckley 1973). It and the desert sucker are the two most comon larger fishes in the Colorado basin (Rinne and Minckley 1991). It is abundant in the Gila River and Bill Williams River basins, including the Verde River, Salt River, and San Francisco River drainages (Minckley 1973, Sublette et al. 1990). Populations of the species appear to be widespread, abundant, and stable (Sublette et al. 1990).

Sonora suckers typically inhabit pools; young Sonora suckers tend to inhabit runs and quieter eddies (Rinne and Minckley 1991). The species exhibits little seasonal movement, resisting downstream displacement even during flooding periods (Bestgen et al. 1987). They appear to be tolerant of cooler temperatures, as they are found in both warm and cool water streams (Sublette et al. 1990), but they are apparently intolerant of lake conditions (Minckley 1973). There is no apparent correlation between spawning and stream temperature or flow (Minckley 1973).

Sonora suckers typically feed crepuscularly on the aquatic insect larvae and other macroinvertebrates in shallow pools

(Sublette et al. 1990, Rinne and Minckley 1991). Vegetation is rarely consumed (Rinne and Minckley 1991), but cottonwood seeds are sometimes taken from the waters surface (Minckley 1973). Spawning occurs from February through early July. Sonora suckers move to smaller streams, or riffles in larger streams, to spawn, though some will spawn in lakes (Minckley 1973). Reproduction involves two males and a single female, the males positioned on each side of the female. Gametes are emitted while adults agitate the substrate, and the fertilized eggs fall into the interstices of the gravel to develop.

**Roundtail chub** (*Gila robusta*)

The roundtail chub is a medium-sized fish that varies widely in size. Adult lengths may be as small as 150 mm or as large as 650 mm, depending on the population (Rinne and Minckley 1991). The species is widespread, generally found in the larger streams of the Colorado basin as far north as Wyoming. In particular, it is found in the lower portion of the Virgin River system, the Bill Williams River and Gila River drainages, including the Verde and Salt rivers and their tributaries. Although Minckley (1973) suggests the species is capable of persisting fairly well in the presence of introduced fishes, it has been extirpated from the Zuni and San Francisco drainages in New Mexico, and is diminishing in the San Juan and Gila drainages (Sublette et al. 1990). A subspecies of the roundtail chub (*G. r. seminuda*), found only in the Virgin River drainage is state listed as an Endangered Species in Arizona (Arizona Game and Fish Dept. 1988).

The Colorado roundtail chub (*G. r. robusta*), the main subspecies found throughout Arizona and New Mexico, is state listed as a Threatened Species in Arizona (Arizona Game and Fish Dept. 1988) and as an Endangered Species in New Mexico (Sublette et al. 1990).

The roundtail chub inhabits pools and rapids of medium to large rivers and large reservoirs (Sublette et al. 1990). Larger fish dwell in deep pools ($\bar{x}$=64cm) while smaller fish seek shallow areas of 20-32cm (Bestgen in Sublette et al. 1990, Rinne and Minckley 1991). The species as a whole prefers pools and eddies below riffles, and often are found in slow waters beneath cut banks or near boulders in stronger currents (Rinne and Minckley 1991). Roundtail chub appear to prefer temperatures in the range of 22-24$^0$ C (Sublette et al. 1990).

Roundtail chub are primarily opportunistic carnivores, feeding on small fish, terrestrial and aquatic insects (Sublette et al. 1990), and may even take small terrestial vertebrates such as lizards (Rinne and Minckley 1991). Occassionally filamentous algae is consumed (Sublette et al. 1990, Rinne and Minckley 1991). Spawning occurs in spring and early summer in pools of moderate flow. Adhesive eggs are laid in gravel and cobble substrates (Sublette et al. 1990) or beds of submergent vegetation or other cover (Rinne and Minckley 1991).

**LEOPARD FROGS**

There are several leopard frogs in the summer range of migrant black-hawks. They are similar in appearance, and, where

ranges border, difficult to identify unless in the hand. Some hybridization is known to occur. A unifying feature of all leopard frogs is their dependence upon water for egg deposition. They prey primarily on insects.

Geographic widespread declines or local extirpation of ranid frog population in the US over the last century have been noted by numerous researchers (see Hayes and Jennings 1986 for review). Surveys of 36 localities supporting leopard frog populations in the 1960's and 70's found only two areas still supporting leopard frogs (Clarkson and Rorabaugh 1989). Increasing concern for the health of ranid populations has promoted recent and ongoing field studies. However, there is a lack of information for many leopard frog species, especially in the southwestern United States. The following accounts are summarized from Stebbins (1985).

**Northern leopard frog** (*R. pipiens*)

The northern leopard frog has the widest range of the leopard frogs, occupy areas from central Canada, south through the central United States into Arizona and New Mexico, and from the Pacific northwest east to the Atlantic coast. Within the migrant black-hawks summer range, it occurs in Utah, Arizona from the Mogollon rim north, and northern New Mexico with a population along the Rio Grande River as far south as Texas. It is found at elevations ranging from sea level to 3,350 m. This leopard frog is listed as a Candidate Species in Arizona (Arizona Game and Fish Dept. 1988).

The species occurs in a variety of landscapes; grasslands, brushlands, woodlands, and forests. It inhabits almost any type of water source (i.e., springs, streams, marshes) where there is permanent water and abundant aquatic plants. In moister areas it may forage in meadows some distance from water.

It is a medium sized frog, with a snout to vent length of 5-11.5 cm. It escapes predators by leaping into water and swimming to the bottom or, if on land, retreating to water in a series of zigzag leaps. Breeding occurs from mid-spring until early summer.

**Chiricahua leopard frog** (*R. chiricahuensis*)

The range of the Chiricahua leopard frog is the mountain areas of central and southeast Arizona, southwest New Mexico, and south to Durango, Mexico at elevations of 1,070-2,410 m. The population status of this species is poorly known and it is state listed as a Threatened Species in Arizona (Arizona Game and Fish Dept. 1988).

The species primarily occupies aquatic habitats adjacent to oak and mixed oak-pine woodlands, and pine forests, but may be found in chaparral, grasslands, and desert. It is a very aquatic species, seldom found away from water. It inhabits streams and deep pools at higher elevations, springs, oxbows, ponds, and stock tanks at lower elevations.

The Chiricahua leopard frog is medium sized, with a snout to vent length of 5-13.5 cm. Breeding periods are variable. At higher elevations, breeding occurs through the summer, mid-spring

through early summer and sporadically through autumn at lower elevations.

Lowland leopard frog (*R. yavapaiensis*)

The lowland leopard frog ranges from the Colorado River region of California, across central and southeast Arizona and southwest New Mexico, from elevations of sea level to 1,460 m. This frog is state listed as a Candidate Species in Arizona (Arizona Game and Fish Dept. 1988).

The species occurs in desert, grassland, oak, and oak-pine woodland landscapes. It is almost always found close to water, inhabiting permanent springs and pools in streams, ponds, side channels of rivers, and stock tanks.

The lowland leopard frog closely resembles and hybridizes with the Chiricahua leopard frog. Only recently has the lowland leopard frog been designated as a distinct species, primarily based on biochemical differences. Species accounts are incomplete, and life history is apparently similar to the Chiracahua leopard frog.

**Relict leopard frog** (*R. onca*)

Considered extinct (Arizona Game and Fish Dept. 1988). The relict leopard frog once occured in the very limited range of the Vegas Valley, Nevada, and the Virgin River drainage of southwest Utah, northwest Arizona, and southeast Nevada. Little was known of the species and all recent leopard frogs found in its range have been identified as lowland leopard frogs (Arizona Game and Fish Dept. 1988).

**Rio Grande leopard frog** (*R. berlandieri*)

The Rio Grande leopard frog has the limited range of extreme southern New Mexico, west and central Texas, and south into Mexico along the Rio Grande River. Although it primarily inhabits streams, it can also be found in side pools of rivers, springs, and stock tanks in grasslands and woodlands. It is a medium sized frog with a snout to vent length of 5.6-11.2 cm. It apparently breeds opportunistically following rains at any time of the year.

**LIZARDS**

There is a lack of information beyond basic life history for most reptiles in the desert southwest (D. Swann, per. commun.). Information on population dynamics and current status are non-existent for most species. The following accounts are summarized from Conant (1975) and Stebbins (1985).

**Lesser earless lizard** (*Holbrookia maculata*)

The lesser earless lizard ranges from southern South Dakota, through the great plains into northern Texas, west across New Mexico, southeast Utah, north, central and southeast Arizona, and southward to Guanajuato, Mexico, at elevations from sea level to 2,130 m.

The species inhabits desert grasslands, washes, sandy stream banks, mesquite and pinion-juniper woodlands, and sagebrush flats. It shows a preference for areas with open patches of sand or gravel.

It is a small ground dwelling lizard with a snout to vent

length of 5-6.2 cm. It is adapted for quick sprints across loose substrates. It can escape predators by such sprints or by diving headfirst into sand and quickly burying itself. One or two clutches of up to 12 eggs each are laid from mid-spring through summer. Primary prey is insects, spiders, and smaller lizards.

**Greater earless lizard** (*Cophosaurus texana*)

The greater earless lizard ranges from northern Texas south to Zacatecas, Mexico, and west through New Mexico and to western Arizona, at elvations ranging from 30-1,700 m.

The species avoids lowland deserts and high mountain areas, showing a preference for middle elevational ranges. It inhabits areas with a loose substrate, typically sandy or gravelly flats, washes, or intermittent stream bottoms. Occassionally it may be found on rocky hilsides.

It is a small to medium sized ground dwelling lizard with a snout to vent length of 4.7-7.5 cm. It is a very fast running species, typically avoiding predators by sprinting across open areas. Multiple clutches of as many as 12 eggs are laid from early spring through summer. Total eggs laid seasonally has been speculated to be approximately 25. The diet of the greater earless lizard is apparently limited to insects.

**WHIPTAILS**

At least eleven different whiptails occur in the summer range of migrant black-hawks. These species are numerous and similar; they will be covered here as a genus.

In general, whiptails are slim lizards with long, whip-like

tails. They are diurnal and very active, moving short distances, stopping momentarily, then moving a short distance, and so on. They can move very quickly when frightened.

It can be very difficult to differentiate between some species, but virtually all landtypes between sea level and 2440 m in the desert southwest is occupied by some species of whiptail.

Some species are parthenogenic, consisting entirely of females. Among both parthenogenic and sexually reproducing species, reproduction typically occurs in the summer months with clutches of 1-4 eggs laid. Whiptails eat a variety of prey, incuding insects, spiders, scorpions, centipedes, and termites. They will also eat other small animals including lizards.

Species in the U.S. range of migratory black-hawks.

Canyon spotted whiptail (*Cnemidophorus burti*)
New Mexican whiptail (*C. neomexicanus*)
Little striped whiptail (*C. inornatus*)
Desert grassland whiptail (*C. uniparens*)
Plateau striped whiptail (*C. velox*)
Chihuahuan spotted whiptail (*C. exsanguis*)
Sonoran spotted whiptail (*C. sonorae*)
Gila spotted whiptail (*C. flagellicaudus*)
Western whiptail (*C. gularis*)
Checkered whiptail (*C. tesselatus*)

Appendix 3. Land Ownership of Common Black-hawk Nest Territories by Drainage and Individual Stream. USFS=U.S. Forest Service, BLM=U.S. Bureau of Land Management, ASL=Arizona State Land Dept., PVT=Private Ownership, BIA=Bureau of Indian Affairs (Tribal Lands), TNC=The Nature Conservancy, NPS= National Park Service.

| | USFS | BLM | ASL | PVT | BIA | TNC | NPS |
|---|---|---|---|---|---|---|---|
| Big Sandy | | | | | | | |
|   Bull Canyon | | | 1 | | | | |
|   Burro Creek. | | 8 | 6 | 1 | | | |
|     Boulder Ck. | | 1 | | | | | |
|     Francis Ck. | | 6 | | 2 | | | |
|     Mammoth Wash | | | 2 | 2 | | | |
|     Trout Ck. | | | | 2 | | | |
| Gila River | 8[1] | 3 | | 11[1] | | 2[1] | |
|   Agua Fria R. | | 1 | | | | | |
|     Silver Ck. | | 1 | | | | | |
|   Bonita Ck. | | 5 | | 1 | 1 | | |
|   Eagle Ck. | 5 | 2 | | 5 | | | |
|   Hassayampa R. | | | | 1 | | | |
|   Little Ck. | 2[1] | | | | | | |
|   Mangus Valley | | | | 1[1] | | | |
|   Markham Ck. | | 1 | | | | | |
|   Martinez Ck. | | 1 | | | | | |
|   Mescal Ck. | | 1 | | | | | |
|   Salt River | | | | | | | |
|     Canyon Ck. | 1 | | | | | | |
|     Cave Ck. | 1 | | | | | | |
|     Cherry Ck. | 3 | | | | | | |
|       Buzzard Roost | | | | 1 | | | |
|     Cienaga Ck. | | | | | 1 | | |
|     Cottonwood Ck. | 1 | | | | | | |
|     Reynolds Ck. | 1 | | | | | | |
|     Tonto Ck. | | | | | | | |
|       Haigler Ck. | 1 | | | | | | |
|       No Name Wash | 1 | | | | | | |
|       Spring Ck. | 3 | | | | | | |
|     Verde River | 5 | | | 2 | | | |
|       E. Verde R. | 2 | | | | | | |
|       Beaver Ck. | 1 | | | | | | |
|       Blind Indian Ck. | 1 | | | | | | |
|       Kirkland Ck. | | | | 1 | | | |
|       Lime Ck. | 1 | | | | | | |
|       Oak Ck. | 2 | | 1 | 2 | | | |
|       Pigeon Ck. | 1 | | | | | | |
|       Rock Ck. | 1 | | | | | | |
|       Sycamore Ck. | 2 | | | | | | |
|       Walnut Ck. | 1 | | | | | | |
|       Webber Ck. | 1 | | | | | | |
|       W. Clear Ck. | 3 | | | 1 | | | |

Appendix 3 (Continued).

| | USFS | BLM | ASL | PVT | BIA | TNC | NPS |
|---|---|---|---|---|---|---|---|
| Gila River (Continued) | | | | | | | |
| San Carlos River | | | | | 1 | | |
| Blue R. | | | | | 3 | | |
| San Francisco River | 8 | | | 3[1] | | | |
| Blue R. | 9 | | | | | | |
| Harden Cienaga | 1 | | | | | | |
| Tularosa R. | 1[1] | | | 1[1] | | | |
| San Pedro River | | | | 1 | | | |
| Alder Ck. | 1 | | | | | | |
| Aravaipa Ck. | | 6 | | 1 | | 5 | |
| Turkey Ck. | | 1 | | | | | |
| Bass Canyon | | | | | | 1 | |
| Happy Valley | | | | 1 | | | 1 |
| Hot Springs Canyon | | | 1 | | | 1 | |
| Paige Ck. | | | | | | 1 | 1 |
| Redfield Canyon | 2 | | 1 | | | | |
| Santa Cruz | | | | | | | |
| Sonoita Ck. | | | | | | 1 | |
| Sapillo Ck. | | | | 1[1] | | | |
| Turkey Ck. | 1[1] | | | | | | |
| Mimbres River | | | | 3[1] | | | |
| Rio Grande | | 1[1] | | | | | |
| Virgin River | | | | 1[2] | | | |
| Beaver Dam Wash | | | | 1 | | | |
| Total | 71 | 38 | 12 | 46 | 6 | 11 | 2 |

[1] Nests occurring in New Mexico
[2] Nests occurring in Utah

Appendix 4. Distribution of black-hawk nests on federal lands in Arizona on basis of management unit.

| U.S. Forest Service | n | % |
|---|---|---|
| Clifton Ranger Dist. | 23 | 32.5 |
| Payson Ranger Dist. | 9 | 12.7 |
| Pleasant Valley Ranger Dist. | 6 | 8.5 |
| Wilderness Ranger Dist. | 6 | 8.5 |
| Beaver Creek Ranger Dist. | 5 | 7.0 |
| Silver City Ranger Dist. | 5 | 7.0 |
| Cave Creek Ranger Dist. | 4 | 5.6 |
| Chino Valley Ranger Dist. | 4 | 5.6 |
| Safford Ranger Dist. | 2 | 2.8 |
| Sedona Ranger Dist. | 2 | 2.8 |
| Alpine Ranger Dist. | 1 | 1.4 |
| Bradshaw Ranger Dist. | 1 | 1.4 |
| Mesa Ranger Dist. | 1 | 1.4 |
| Santa Catalina Ranger Dist. | 1 | 1.4 |
| Tonto Basin Ranger Dist. | 1 | 1.4 |
| Total | 71 | 100.0 |
| **U.S. Bureau Land Management** | **n** | **%** |
| Kingman Resource Area | 15 | 39.5 |
| Gila Resource Area | 14 | 36.8 |
| Phoenix Resource Area | 8 | 21.1 |
| Rio Puerco Resource Area | 1 | 2.6 |
| Total | 38 | 100.0 |
| **National Park Service** | **n** | **%** |
| Saguaro National Park | 2 | 100.0 |

Appendix 5. Individuals whom were contacted for information used in this conservation assessment. Not all were able to provide information.

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APPENDIX 6. Attendees: Common black-hawk conservation assessment meeting, 27 November 1995.

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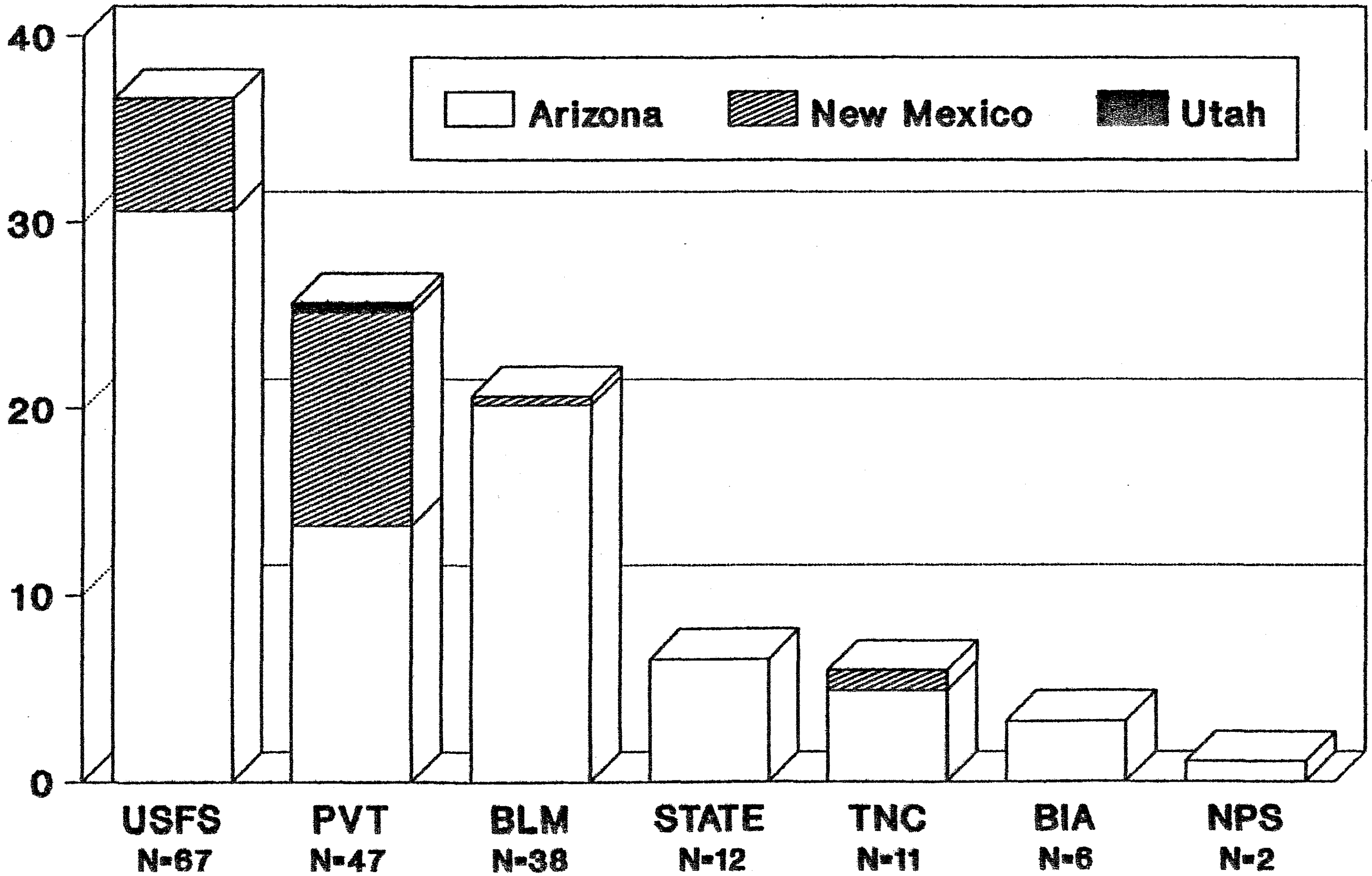
# Common Black-hawk Nest Distribution by State and Land Ownership



# Breeding Range of Migrant Common Black-Hawks